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Fixed ball joint with turned track cross-sections

Claims

1. A constant velocity joint in the form of a fixed joint with the following characteristics:
an outer joint part (12) which comprises a longitudinal axis L12 as well as an attaching end and an aperture end positioned axially opposite one another, and which is provided with outer ball tracks (22_1, 22_2);
an inner joint part (13) which comprises a longitudinal axis L13 and attaching means for a shaft pointing towards the aperture end of the outer joint part (12) and which is provided with inner ball tracks (23_1, 23_2);
the outer ball tracks and the inner ball tracks form pairs of tracks (22_1, 23_1; 22_2, 23_2);
the pairs of tracks each accommodate a torque transmitting ball (14_1, 14_2);
each two adjoining pairs of tracks comprise outer ball tracks (22_1, 22_2) whose centre lines are positioned in planes (E1, E2) which extend substantially parallel relative to one another, as well as inner ball tracks (23_1, 23_2) whose centre lines are positioned in planes (E1', E2') which extend substantially parallel relative to one another;
an annular ball cage (16) is positioned between the outer joint part (12) and the inner joint part (13) and comprises circumferentially distributed cage windows (17) which each accommodate the torque trans-mitting balls (14_1, 14_2) of two adjoining pairs of tracks (22_1, 23_1; 22_2, 23_2);

in an aligned joint, the centres K_1, K_2 of the balls (14_1, 14_2) are held by the ball cage (16) in the joint centre plane EM and when the joint is articulated, they are guided onto the angle-bisecting plane between the longitudinal axes L12, L13;
the track cross-sections of the outer ball tracks (22_1, 22_2) and of the inner ball tracks (23_1, 23_2) of each pair of tracks are symmetrical relative to axes of symmetry (ES_1, ES_2) which, together with the planes (E1, E2, E1', E2'), form identically sized angles (φ_1, φ_2) opening in opposite directions and each comprise a common point(M, M').

2. A joint according to claim 1,

characterised in

that the track cross-sections of the outer ball tracks (22_1, 22_2) and of the inner ball tracks (23_1, 23_2) of each pair of tracks are each symmetrical relative to radial rays (RS1, RS2) from the longitudinal axes (L12, L13) through the ball centres K1, K2 of the torque transmitting balls (14_1, 14_2) of the pair of tracks.

3. A joint according to claim 1,

characterised in

that the track cross-sections of the outer ball tracks (22_1, 22_2) and of the inner ball tracks (23_1, 23_2) of each pair of tracks are each symmetrical relative to straight lines (PS_1, PS_2) which are positioned in the cross-sectional plane and which extend parallel to the radial rays (RS1, RS2) from the longitudinal axes L12, L13

through the ball centres K1, K2 of the torque transmitting balls (14_1, 14_2) of the pair of tracks and which intersect one another in a common point M' at a distance from the longitudinal axes L12, L13.

4. A joint according to any one of claims 1 to 3,

characterised in

that the angles φ_1, φ_2 range from 0.8 to 1.3 φ_0 wherein $2\varphi_0$ constitutes the centre angle in an aligned joint between radial rays (RS1, RS2) from the longitudinal axes L12, L13 through the ball centres (K1, K2) of the balls (14_1, 14_2) of two adjoining pairs of tracks (22_1, 23_1; 22_2, 23_2).

5. A joint according to any one of claims 1 to 4,

characterised in

that the track centre lines (M22) of the outer ball tracks (22_1, 22_2) and of the inner ball tracks (23_1, 23_2) are positioned in planes (E1, E2) which extend parallel relative to one another and parallel relative to the longitudinal axes (L12, L13) of the joint and which extend through the ball centres of the balls (14_1, 14_2) of two adjoining pairs of tracks (22_1, 23_1; 22_2, 23_2).

6. A joint according to any one of claims 1 to 4,

characterised in

that the track centre lines (M22) of the outer ball tracks (22_1, 22_2) extend in first planes (E1, E2) and the

centre lines (M23) of the inner ball tracks (23_1, 23_2) in second planes (E1', E2') which are parallel relative to one another and extend through the ball centres of the balls (14_1, 14_2) of two adjoining pairs of tracks (22_1, 23_1; 22_2, 23_2) and which are at identical perpendicular distances from the joint centre (M), wherein, together with the longitudinal axes (L12, L13), they form identically sized angles of intersection (γ_0, γ_0') extending in opposite directions.

7. A joint according to claim 6,

characterised in

that the angles of intersection (γ_0, γ_0') are selected in such a way that the spatial control angles ε_0, ε_0' of the pairs of tracks at the balls (14_1, 14_2) have the same value irrespective of whether the load turns clockwise or anti-clockwise.

8. A joint according to claim 7,

characterised in

that with a centre angle $2\varphi_0$ between the radial rays (RS1, RS2) through the ball centres K1, K2 of the balls (14_1, 14_2) of two adjoining pairs of tracks (22_1, 23_1; 22_2, 23_2), the angle of intersection γ_0 is calculated in accordance with the equation $\gamma_0 = \varepsilon_0 \times \tan\varphi_0$ to ensure that the spatial control angles are identical regardless of whether the load on the joint rotates to clockwise or anticlockwise.

9. A joint according to any one of claims 1 to 8,

characterised in

that the opening angle (α_1, α_1) between the tangents at the base lines of two adjoining pairs of tracks (21_1, 23_1; 22_2, 23_2) in an aligned joint in the joint centre plane EM each open in the same direction, more particularly towards the attaching end of the outer joint part (twin ball joint).

10. A joint according to any one of claims 1 to 8,

characterised in

that the opening angle (α_1, α_1) between the tangents at the track base lines in the joint centre plane (EM) of two adjoining pairs of tracks (22_1, 23_1; 22_2, 23_2) in an aligned joint open in the joint centre plane EM in opposite directions (counter track joint).

11. A joint according to claim 10,

characterised in

that the balls (14_1, 14_2) of two adjoining pairs of tracks (22_1, 23_1; 22_2, 23) in an aligned joint are positioned on different pitch circle radii (PCR).

12. A joint according to any one of claims 1 to 11,

characterised in

that the track cross-sections of the outer ball tracks (22) and of the inner ball tracks (23) are formed by parabolic or ellipsoidal portions or by pointed arches (Gothic arches) which each generate contact with the balls in two points.

13. A joint according to any one of claims 1 to 11,

characterised in

that the track cross-sections of the outer ball tracks (22) and inner ball tracks (23) are formed by circular portions whose centres of curvature are positioned at a distance from one another on the respective radial ray (RS1, RS2) and, respectively, on the respective straight line (PS1, PS2) extending parallel thereto and that their radius of curvature is greater than the ball radius, and which circular portions generate contact with the balls (14_1, 14_2) in one point.